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Pulsed Corona and Dielectric-Barrier Discharge Processing of Trichloroethylene*

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This paper presents experimental results on the plasma assisted decomposition of dilute concentrations (100-200 ppm) of trichloroethylene (TCE) in atmospheric-pressure dry air streams by pulsed corona and dielectric-barrier discharge processing. The experiments were performed at gas temperatures up to 300°C. One of the objectives in these experiments is to study the effect of gas temperature on the removal chemistry and product formation. The data on the gas temperature dependence provide a good basis for elucidating the chemical kinetics of TCE decomposition in the plasma. Under identical gas conditions (i.e. gas composition and gas temperature), the type of electrical discharge reactor does not affect the electrical energy requirements for decomposing the same amount of TCE; the reactor type also does not affect the product formation. For input energy densities up to 300 Joules per liter, we observe that carbon monoxide (CO) and carbon dioxide (CO_2) are only minor products in the decomposition of TCE. The main organic products are phosgene and dichloroacetyl chloride (DCAC), as inferred from the Fourier Transform Infrared (FTIR) spectra. Processing at higher gas temperatures (around 300°C) increases the electrical energy required to remove the same amount of TCE; however, the CO and CO_2 yields increase substantially and higher amounts of hydrochloric acid (HCl) are formed. These trends suggest increased

competition from decomposition of DCAC and/or phosgene at high temperatures. In all cases, pulsed corona or dielectric-barrier discharge processing produces CO preferentially over CO_2.

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